

## Nesting biology of Striated Herons *Butorides striatus* in Darwin, Northern Territory

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### Introduction

Unlike elsewhere in its pantropical range, where it may be found to 4 050 m above sea-level (del Hoyo *et al.* 1992), the Striated or Green-backed Heron *Butorides striatus* in Australia is largely associated with intertidal areas and as a consequence has a strictly coastal distribution. While its affinity for mangals (mangrove communities) spawned the popular name 'Mangrove Heron', the species more than occasionally occurs in freshwater wetlands in Australia, as well as on reefs and beaches far from mangals. For a species occurring around at least two-thirds of Australia's coastline, including Sydney and Brisbane, surprisingly little has been recorded about its breeding biology, as evidenced by only 13 records in the Birds Australia Nest Record Scheme (NRS) until 1990 (Marchant & Higgins 1990). One of the earliest observations of nesting by the species originates from Port Essington, Northern Territory, where the naturalist John Gilbert reported a colony of some 30 birds nesting in mangroves and yellow hibiscus (North 1913). However, as noted by Hindwood (1933) in his detailed account of the nesting behaviour of Striated Herons in Sydney Harbour, this species normally nests solitarily. Indeed, Marchant and Higgins (1990) rejected the claims of Gilbert and others of colonial nesting by the species.

In the Northern Territory (NT), the Striated Heron (race *stagnatilis*) is fairly evenly distributed around the mainland coast and offshore islands, with no areas of obviously higher densities (Chatto 2001). Chatto (2001) concluded that Striated Herons breed as single pairs all around the NT coast, although he reported one breeding "colony" containing five nests on the mid north coast. In this paper I summarise opportunistic observations of 32 nests of the species in the Darwin region, all but four from around Nightcliff reef, and clarify the breeding season, clutch size and spatial distribution of nests of the species in this region. I also provide the first description of the nestling of this race, and a possible pre-copulatory display involving reddening of the bare parts and a low booming call.

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## Methods

Opportunistic observations were made of nesting Striated Herons in mangal near Nightcliff reef (12°23'12"S, 130°50'40"E) and other coastal areas in the Darwin region, between 1998 and 2006, during studies of mangrove phenology and mangal-dwelling passerines. The nests at Nightcliff were found within a near-continuous 500 m stretch of mangal, varying in width from 50 to 90 m, and fringing rock platforms or narrow sandy beaches. For accessible nests, I climbed the nest tree, but for most, I used a mirror mounted on a pole to check the contents. For nests that produced chicks, I estimated the age of chicks from descriptions in Hindwood (1933) and estimated the laying date of the clutch, based on a maximum incubation period of 25 days (Hindwood 1933). Otherwise I assumed the laying date to be in the same month as the complete clutch was found, unless this date fell within 3 days of the start of a month, in which case the clutch scored 0.5 for that month and 0.5 for the preceding month. The height of nests and nest trees < 4 m was measured using a tape measure, but otherwise estimated to the nearest metre. Nest trees were identified to species; English names follow those given by Wightman (2006). Geographical coordinates of nest trees were recorded using a GPS unit, with accuracy to about 10 m, and inter-nest distances were calculated using 'OziExplorer' GPS mapping software.

## Results

Most nests were found in the northern portion of the Nightcliff reef mangal, which was overwhelmingly dominated by Small Stilt-root Mangrove *Rhizophora stylosa*, except in the small sheltered bay closest to suburban houses, where Pornupan (Star) Mangrove *Sonneratia alba* was co-dominant. Fewer nests were found in the mangal along the southern border of the southernmost rock platform, where Pornupan Mangrove was clearly dominant. Eggs were found from August to March, with almost two-thirds (64%) in the two months of September and October (Figure 1). However, no nests were found at Nightcliff reef beyond January, and the three nests in March were at Shoal Bay (2) and lower Rapid Creek. An additional record of a nest with a well-developed chick from Sandfly Creek, Casuarina Coastal Reserve (G. and M. O'Brien, pers. comm.), suggests egg-laying in November.

The nests were typically rather untidy platforms of sticks, built in the forks of branches of mangroves. Of 31 active nests, 25 (80.6%) were built in Small Stilt-root Mangroves, three in Pornupan Mangrove, two in Grey Mangrove *Avicennia marina* and one within a Mangrove Mistletoe *Anyema mackayensis* clump on a Small Stilt-root Mangrove. However, several of these nests were apparently refurbished nests from the previous season(s). The heights of 22 nests (excluding known refurbished nests) varied from 2.0 to 6.3 m, averaging 4.27 m (SD  $\pm$  1.14), while the heights of 14 nest trees varied from 3.8 m to 9.0 m, averaging 6.3 m (SD  $\pm$  1.7), excluding one nest tree (in *S. alba*) that was estimated to be c. 20 m in height, at Shoal Bay. The closest

distances between two concurrent nests found in any one season were 34 m (1999), 33 m (2000) and 57 m (2006). In 2005, three nests formed a triangle with inter-nest distances of 19, 34 and 36 m.

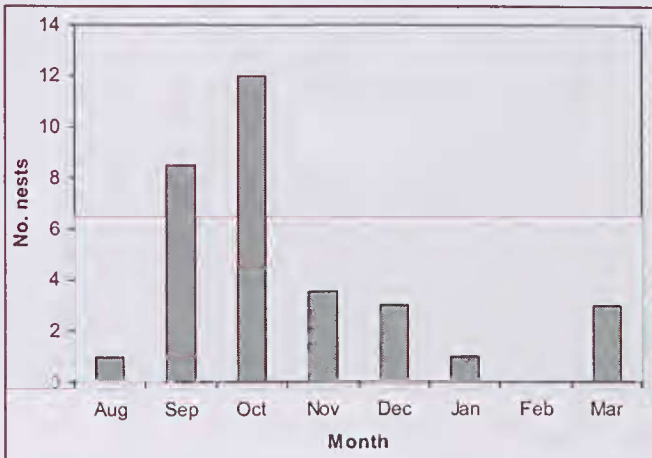


Figure 1. Estimated egg laying dates of Striated Herons in the Darwin region ( $n = 32$ ). Where dates straddled two months, each month was assigned 0.5.

Of 14 clutches seen in the Darwin region, 12 were of two eggs and the remaining two were of one and three. Of an additional 13 nests, in which only young were observed, nine contained two chicks; the remaining four nests contained one chick only, although it is possible that some had lost a second chick due to premature fledging or predation. From these data it seems safe to conclude that two is the normal clutch of the species in the Darwin region (Figure 2).

Of two young nestlings at a nest on 5 January 1999, one was found on the ground below its nest 15 days later, while the other remained in the nest. The period between first and last sightings of nestlings at four other nests was 13 ( $n = 2$ ) and 14 days ( $n = 2$ ). At one of the latter nests, only one of the two nestlings had disappeared on the 14th day since their discovery, suggesting different fledging times, perhaps due to asynchronous laying. In a separate instance, two young (one perched 2 m from the nest, the other on the ground) were observed 18 days after eggs had been seen in the nest, indicating a maximum nestling period of 18 days for the fledged bird. Furthermore, one nest gave a minimum total nest period of 39 days, from the first sighting of eggs to the last sighting of chicks perched 1-2 m from the nest, while at another nest, a fledgling was found below its nest 42 days after eggs had been recorded.



Figure 2. Nest and eggs of the Striated Heron at Nightcliff reef.

Nestlings were not inspected closely due to either the inaccessibility of nests or the high risk of premature fledging. However, on 14 October 1997 I found a prematurely fledged bird 2 m below its nest, and 3 m from the ground (photograph on rear cover). The bird was c. 20 cm from bill tip to cloaca. Pale grey down covered much of its body, mostly concealing its skin, which was lime-green. There were short brown quills on the wings only, and an unfeathered patch of yellow skin around the cloaca. The legs and feet were green with yellow soles; the iris was yellow and bill pale grey.

Nests were not monitored sufficiently to determine fledging success. However, fledglings from five nests were discovered on the ground and were capable of running at speed amongst the roots of the Small Stilt-root Mangroves dominating the habitat. In 1998, one nest was depredated within seven days after eggs had been recorded. In this year I also watched a small group of indigenous people roasting a freshly caught Striated Heron chick on a small fire built on the beach c. 50 m from a nest I had observed. In 2000, a Black Butcherbird *Craicticus quoyi* approached to within 3 m of a nest with eggs, but this potential predation event was thwarted by the prompt action of the incubating heron returning to sit on the nest. In 2002 two nests which had eggs on 31 Oct. were empty by 16 Nov., but as this is just within the time frame given for young to clamber out of the nest (see Discussion), nest predation cannot be assumed.

On 23 September 2006 I witnessed a possible pre-copulatory display by a motionless adult perched c. 6 m from the ground in a Small Stilt-root Mangrove (c. 9 m tall) in which a nest with eggs was found three weeks later. The bird gave at least six low



booming growl-like calls (“hwow”) at 2-3 min intervals, and its facial skin (eye-ring and lores) and legs were strongly suffused with red, appearing a deep salmon-pink.

## Discussion

The above observations clearly indicate that egg laying by Striated Herons around Darwin begins in late August, peaks in September-October, and extends until March, thus straddling the late dry and wet seasons. On the mid-north coast of the NT, Chatto (2001) found five nests containing eggs and small young in March, but suspected that breeding occurred between September and January at several other sites. Moreover, the Birds Australia NRS contains one record of an occupied nest in April in the NT (Marchant & Higgins 1990). Thus, the breeding season in the NT is considerably longer than the three months (November to January) given by Storr (1977), and appears to be longer than in Western Australia (August to January) or the Sydney region (September to January) (Hindwood 1933, Johnstone 1990, Marchant & Higgins 1990). Given that pairs normally rear two broods per season in the Sydney region (Hindwood 1933), it is likely that pairs in the Darwin region also at least occasionally raise second broods, although this was not investigated in the present study.

Not dependent on the flooding of seasonal wetlands, Striated Herons in the Darwin region commence nesting 4-5 months earlier than other herons breeding in the Top End. In colonies of egrets and Pied Herons *Ardea picata* in the NT, eggs appear mainly from mid January to late March or early April, except in the case of the Cattle Egret *A. ibis*, which commences breeding as early as late November (Chatto 2000). As breeding is generally synchronous within colonies, young tend to be present in March and April, with the last young leaving by late June (Chatto 2000). The only other heron species breeding colonially in the NT is the Nankeen Night Heron *Nycticorax caledonicus*, which breeds between March and June (Chatto 2000). The late dry breeding season peak of Striated Herons, by contrast, more closely resembles the breeding activity of large terrestrial insectivorous passerines in the region (Noske & Franklin 1999). The Eastern Reef Egret *Egretta sacra*, a species with a similar coastal distribution to the Striated Heron, may also have an early breeding season in the NT. Chatto (2001) found few active nests of this species, but suggested that it bred in pairs or small groups from August to December.

Gilbert's report of colonial breeding by some thirty Striated Herons at Port Essington was dismissed by Marchant and Higgins (1990) on the grounds of “probable confusion with Nankeen Night Herons, unsuitable habitat and small clutch size”. There are no recent records of heron breeding colonies in the Port Essington area, but Chatto (2000) found most colonies (with an average of 700 birds) of Nankeen Night Herons in mangals, similar habitat to that of the Striated Heron. Moreover, all of Gilbert's nests contained either two eggs or two young, which seems consistent with my observations of the clutch size of local birds. Chatto (2001) reported one

breeding "colony" containing five nests on the mid north coast of the NT but gave no further particulars. Indeed, elsewhere in the world the species is known to breed alone or in small groups, exceptionally forming colonies of up to 300-500 pairs, and rarely nesting alongside other species (del Hoyo *et al.* 1992).

At Tuggerah Lakes on the central coast of New South Wales, Morris (1990) reported a breeding "colony" of three nests of Striated Herons among nine nests of the Little Egret *E. garzetta*. As Marchant and Higgins (1990) noted, however, these three clutches were started 3-10 weeks apart, and were well spaced, with inter-nest distances of 61, 67 and 87 m (Morris 1990). These distances are indeed greater than those I measured at Nightcliff in 2005 (19-36 m). That concurrent nests closer than 60 m were found in most years at Nightcliff suggests that the local population is loosely colonial, with pairs probably benefiting from improved vigilance against predators.

Most nests in the Darwin region were built in Small Stilt-root Mangroves, and the clutch size was usually two, though one clutch of three was observed. In mangals of northern Western Australia, nests are said to be placed mostly in *Avicennia* and *Rhizophora*, and contain clutches of two or three (Johnstone 1990). In Sydney, the clutch size is three or four, mostly three (Hindwood 1933), while in the Clarence district of north-eastern New South Wales, clutches of four eggs are reputedly typical (North 1913). Whilst these data suggest a general increase in clutch size with latitude, as is typical for many species in the North Temperate region, there are insufficient Australian data to test this trend. Elsewhere the species is known to lay clutches as large as eight (del Hoyo *et al.* 1992).

Although the nestling period of the Striated Heron in Australia has not been precisely timed, young birds in Sydney Harbour usually spent about four weeks in the nest or nest tree after hatching (Hindwood 1933). Combined with the 21-25 days of incubation, the total nest cycle should be 49-53 days. However, Hindwood (1933) found that 3-week old nestlings would sometimes drop into the water or onto the mud, and swim or run away with ease; and that even 16- or 17-day old nestlings would "make off into the outer branches" and remain motionless if the nest was approached. Morris (1990) observed that even 12-day old nestlings climbed up to 2 m from the nest when capture was attempted. This is consistent with behaviour I observed in Darwin, and it is possible that the apparently short nestling periods and total nest period (39-42 days) I recorded are due to nestlings straying to places where they could not be detected, aided by their cryptic behaviour.

Hindwood (1933) reported that the down covering of nestlings in Sydney (race *macrorhyncha*) predominates until the ninth or tenth day, after which the quill sheaths start to become dominant and the bright green colour of the skin becomes evident. This description is consistent with the bird I photographed (rear cover), suggesting that the local race is similar in nestling morphology to southern birds.

I can find no reference to a pre-copulatory display, but Marchant and Higgins (1990) state that during breeding, possibly during courtship only, the iris becomes bright yellow, the legs and feet become yellow or orange, and "several quiet calls" are given (original sources unknown). However the bird I watched in September 2006 gave distinctive booming calls, and had reddish bare parts. In Western Australia the legs and feet of *stagnatilis* normally range from light green to bright yellow, the facial skin greenish-yellow or yellowish-green and the irides yellow to bright yellow (Johnstone 1990). Schodde *et al.* (1980) noted that breeding birds, at least in Arnhem Land, acquire a dull-orange tone to the legs, which at other times are dull olive, with a yellowish stripe along the soles. Yet they do not mention seasonal changes in the colour of the facial skin. Clearly more information is required to determine temporal variation in the coloration of bare parts of the species.

Little is known about breeding success of the Striated Heron in Australia. Hindwood (1933) suspected crows (*Corvus* spp), White-bellied Sea-Eagles *Haliaeetus leucogaster* and Grey Shrike-thrushes *Colluricincla harmonica* were predators of nests of Striated Herons in Sydney. Nests are at least occasionally destroyed by storms and high tides (Marchant & Higgins 1990), and possibly lizards (North 1913). From observations in Darwin, humans, and possibly Black Butcherbirds, can be added to the list.

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